

## B.11 PLANETARY INSTRUMENT DEFINITION AND DEVELOPMENT

### 1. Scope of Program

The Planetary Instrument Definition and Development (PIDD) program supports the advancement of spacecraft-based instrument technology that shows promise for use in scientific investigations on future planetary missions. The goal of the program is not to develop flight-qualified hardware but rather to define and develop scientific instruments or components of such instruments to the point where the instruments may be proposed in response to future announcements of flight opportunity without additional extensive technology development. Results of the PIDD program have contributed to the eventual development of flight hardware flown on, or selected for, many of NASA's planetary missions. The proposed instrument technology must address specific scientific objectives of candidate future technology validation and science missions.

Instrument definition and development studies can take place at several stages, including feasibility studies, conceptual design, and laboratory breadboarding (but not brassboarding) of critical components and complete instruments. Particularly for immature or very complex new instruments, proposers initially may choose to only define or develop the most risky components. If the proposal is for a component only, one or more likely scenarios for possible follow on instrument development should be described. Scientific objectives of the instruments, proposed follow on instruments, and future candidate missions should be discussed in every proposal. Proposed instruments must address significant scientific questions relevant to stated NASA goals. The emphasis in this NRA is also on the development of miniaturized, low power, low cost instruments for Discovery, New Frontiers, Mars Exploration, and other similar missions. New measurement concepts, methods to significantly improve the performance of existing instruments, and development of technologies that enable integrated instrument packaging (architectures) may also be proposed.

Proposals not appropriate for the PIDD program are those that seek to develop laboratory instruments, ground-based or airborne telescopes, auxiliary instrumentation such as spectrometers for telescopes, onboard data processing or data compression studies, or any spacecraft technology that does not directly address science instrumentation. In addition, instrument definition and development proposals for instruments having Astrobiology objectives should be submitted to the Astrobiology Science and Technology Instrument program (ASTID; Appendix A.2.13) rather than this PIDD program.

While this program element will be advertised annually, the nature of specific efforts selected for funding will vary, with emphasis in any given year placed on preparation for the nearest term missions for which instruments have not yet been selected. However, support may also be provided for long lead-time definition studies, for innovative approaches that may provide entirely new classes of instruments, for the development of new enabling technology for missions farther in the future, and/or for detector development studies that may advance the technology for a wide range of planetary instrumentation applications. Therefore, proposers are encouraged to relate their

proposed efforts as closely as possible to specific future planetary missions and demonstrate how their technology addresses the scientific goals of these missions.

Finally, note that to enable the NASA Office of Space Science to properly evaluate the relevance of proposals submitted to its programs, as well as to track its progress towards achieving its goals as mandated by the Government Performance Review Act (GPRA), all research supported by NASA's programs must now demonstrate its relationship to NASA Goals and Research Focus Areas (RFAs) as stated in the latest version of its Strategic Plan (follow links from the Web site <http://spacescience.nasa.gov/>); see also the discussion in Section I of the *Summary of Solicitation* of this NRA. Therefore, all proposers to this program element are asked to state their perception of this relevance in terms of the Goals, Science Objectives, and RFAs given in Table 1 found in the *Summary of Solicitation*. In particular, this program element is designed to help fulfill all of the RFAs for all of the Science Objectives for Goal II for the Solar System Exploration science theme. The appropriate place for this statement of relevancy is in the introduction to the proposal's "Scientific/Technical/Management" section (see Section 2.3.5 in the *Guidebook for Proposers*). The index numbers in this table may be used to identify a specific RFA, for example, "Goal I, Sun-Earth Connection Theme, RFA 1(c)" or "Goal II, Astronomical Search for Origins, RFA 3(b)."

## 2. PIDD Program-Focused Future Missions

Proposals for instrument definition and breadboard development for the following future types of missions will be considered for funding through the PIDD program.

- *Discovery Program*

The Discovery Program is envisaged as a series of focused, quick turnaround missions. Development time will be approximately 36 months, and solicitations occur approximately every 18-24 months as the budget allows. The Discovery missions may include flybys, orbiters, landers, the deployment of airplanes or balloons in planetary atmospheres, Earth-orbiting telescopes, and sample return missions to a variety of Solar System objects to study surface and atmospheric composition, thermal structure, meteorology, geoscience, topography, dynamics, and field and particle environments. Instrumentation and techniques addressing critical scientific questions in this broad range are appropriate development efforts under the PIDD program. Technology applicable to multiple missions and investigations will have higher priority for funding. Conversely, proposals for the development of instruments for missions already selected for flight or selected for Discovery Phase A study and/or development will not be accepted under this NRA.

- *Mars Exploration Program (MEP) Missions*

The PIDD program seeks new concepts for in situ Mars scientific instrumentation and experiments, including, but not limited to: potential instruments for radiometric age-

dating (for absolute age determination), soil/rock mineralogy and chemistry (including key isotopic ratios, elemental analyses that include hexavalent Cr, and organic molecules), water/ice detection and characterization, drilling/coring, and atmospheric analyses (including trace gas species detection, including as an example CH<sub>4</sub>, ozone, SO<sub>2</sub>, etc.). Some, but not all, of these are truly new and complex instrument concepts for planetary exploration. As such, proposers may choose to initially pursue only development of the most challenging components as long as discussion of their connection to possible future instruments and scientific objectives is clearly discussed. Future MEP missions, including mobile analytical laboratories, reconnaissance orbiters, airborne experiments, and bore-hole measurement systems, will have payloads of small, lightweight, low power consumption instruments and will launch approximately every 26 months. Instrument development proposals for both U.S. and international follow-on missions to Mars (i.e., beyond the 2009 Mars Science Laboratory (MSL)) are appropriate under this NRA. Instrument technologies for the *in situ* exploration of Mars are of particular interest for future missions. However, next-generation orbital experiments that considerably advance the state of the art (as will be demonstrated on the 2005 Mars Reconnaissance Orbiter), are also encouraged, with particular attention to orbital detection of evidence of organics, liquid water, climate records, and geophysics.

- *New Frontiers Missions*

This PIDDP program solicits instrument concepts relevant to possible future New Frontiers missions that will be solicited for specified targets in the Solar System. The current New Frontiers Announcement of Opportunity (AO 03-OSS-03) lists four candidate missions identified by the NRC Decadal Survey for exploration of the Solar System, entitled *New Frontiers in the Solar System* (2003). These missions are Venus In Situ Explorer, Lunar South Pole-Aitken Basin Sample Return, Jupiter Polar Orbiter and Probe, and Comet Surface Sample Return. Proposers are encouraged to review the New Frontiers AO and Decadal Survey to learn more about these missions. It is anticipated that the first mission selections will be announced in June 2004. Emphasis in this PIDDP program instrument selection will be placed on preparation for the nearest term missions that have not been selected for study or development.

### 3. Programmatic Considerations

Proposals are solicited under this NRA for instrument definition and development only for the missions or classes of missions described in Section 2 above. Therefore, all proposals submitted to this program element must specify:

- The mission or class of missions for which the proposed instrument is applicable Instruments that might fly on a number of missions will be given priority over those applicable to only a single mission.
- The science objectives of the proposed instrument. The relationship between the science objectives and the instrumental capabilities must be clearly demonstrated. For those instruments applicable to many missions or capable of meeting multiple

science objectives, examples of science objectives for the proposed mission or missions must be given.

- Technological advances to be pursued as an inherent element of achieving the science objectives. Proposers must identify potential mechanisms that could facilitate transfer of these technologies to other users, including the private sector, for possible application beyond the immediate one of meeting mission science objectives.

It is anticipated that the scientific payloads on all future Solar System Exploration missions will be limited to small, low mass, low power consumption, and low cost instruments. For this reason, only proposals for instrument definition and development satisfying these general specifications will be considered for support.

The evaluation criteria in the *NASA Guidebook for Proposers – 2004* (see further below) are fully applicable to this program element, including evaluation of scientific and technical merit, relevance to NASA's objectives, and cost risk and reasonableness. In addition, however, the determination of a proposal's relevance shall also take into account the following factors:

- The extent to which the proposed instrument is applicable to multiple missions in the Exploration of the Solar System science theme and/or Origins of Solar Systems program element (see Section 2);
- The extent to which the instrument addresses a priority science goal of the mission or missions for which it would be a candidate for flight;
- Either the near-term nature of the mission or missions in question, or the necessity of embarking on a long lead-time development of a very important instrument contemplated for flight on a mission that is of high priority, even though it is not in the near-term queue; and
- Whether the instrument is deemed to fall within the scope of PIDD program, including whether it is too developmentally mature for PIDD program.

It should be noted that the contemplated sequence of missions described in this NRA is a best current estimate and is subject to change. NASA reserves the right to make a determination of relevance based on the contemplated sequence of missions as it is understood at the time of proposal evaluation and selection.

Full, new proposals are sought for either entirely new studies or for the extension of PIDD studies terminating in FY 2004. Proposals may specify periods of performance of up to three years. It is expected that there will be approximately \$2.5M dollars available for new proposals, and that 10 to 15 studies will be supported with these funds.

As a change from past practices for this program, and in anticipation of a new master data base for OSS research awards that is being implemented on an evolving basis, Annual Progress Reports (called "Progress" or "Status" Reports in previous research solicitations) for ongoing multiple-year awards are no longer required at the time that new proposals are due. Instead, an *Annual Progress Report* will be due no later than 60 days in advance of the anniversary date of the award and is to be submitted as an attachment to an E-mail message to the Program Officer for this program. Note that as an additional change from past practice, a revised budget for any remaining years of an approved award is neither necessary nor expected; the multiple year budget approved at the time of the original award is considered binding barring the development of unforeseen, extreme issues (see Section D.4 of Appendix D of the *NASA Guidebook for Proposers* for further details).

### IMPORTANT INFORMATION

As discussed in the *Summary of Solicitation* of this NRA, the Office of Space Science (OSS) now uses a unified set of instructions for the preparation and submission of proposals given in the document entitled *NASA Guidebook for Proposers Responding to NASA Research Announcement - 2004* (or *NASA Guidebook for Proposers* for short) that may be accessed by opening <http://research.hq.nasa.gov/> and linking through "Helpful References," or by direct access at <http://www.hq.nasa.gov/office/procurement/nraguidebook/> (note that the updated 2004-edition of the *Guidebook* is used for this solicitation).

Section IV(b) of this NRA's *Summary of Solicitation* contains the Web address relevant to the electronic submission of a Notice of Intent (NOI) to propose and a proposal's *Cover Page/Proposal Summary/Budget Summary*, as well as the mailing address for the submission of the hard copies of a proposal.

**As a modification to the default specification in the *Summary of Solicitation* of this NRA, 18 copies of the proposal are required, plus the signed original.**

Questions about this program element may be directed to the cognizant Program Officer:

Dr. Marilyn Lindstrom  
Solar System Exploration  
Code SE  
NASA Headquarters  
Washington, DC 20546-0001

Telephone: (202) 358-1254  
Facsimile: (202) 358-3097  
E-mail: Marilyn.M.Lindstrom@nasa.gov

---